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CENTRAL INTELLIGENCE AGENCY

REPORT

INFORMATION REPORT

CD/NO/

COUNTRY USSR/Finland

DATE DISTR. 20 April 1951

SUBJECT Metallurgical Examination of Soviet Annular Ball Bearing

NO. OF PAGES 2

PLACE
ACQUIRED [REDACTED] 25X1A

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1. The life of the Soviet bearing 2GLZ under test was compared with that of three similar American bearings which were tested as controls. The hours life to failure of the bearings was as follows:

Domestic Bearings

No. 1	-	116.5	hours
No. 2	-	116.5	98
No. 3	-	24.75	11
No. 4	-	119.25	98

Soviet 2GLZ

406 hours

2. The physical properties of the Soviet bearing 2GLZ and of domestic control bearings Numbers 1 and 2 are reported as follows:

No. 1

No. 2

'2GLZ

Rockwell "C" hardness

Inner race	63.3	63.3	64
Outer race	63.1	62	63.4
Balls (Max. Avg. Min.)	66; 64.5; 63	66; 64.5; 62	66; 63.5; 61
Retainer	79.5	80	79.5

Rockwell "B" hardness

Retainer	58	59	58
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Magnaflux examination

all parts OK all parts OK all parts OK

Nitral etch examination

all parts OK all parts OK all parts OK

Fracture grain size

Inner race	9.5 7	9.75	6.25
Outer race	9 7	9 7	9
Balls	9 -	9	8.5 - 9.5

Non-metallic rating*

Inner race	not acceptable	just acceptable	not acceptable
Outer race	-	acceptable	not acceptable
1 ball	not acceptable	not acceptable	not acceptable

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*Non-metallic rating based on micro-examination reported in Paragraph 3 below.

3. The heat treating of the 2GLZ bearing was unacceptable by USA standards, and the count of non-metallic inclusions (principally oxide and manganese sulphide stringers) was sub-standard for all parts of this bearing.

Available from the CIA Library are photomicrographs of bearings 1 and 2 and bearing 2GLZ as follows: (a) Photomicrographs at 1000 diameters etched with Vilella's Reagent to show grain size; (b) Photomicrographs at 100 diameters, metal etched, to show structure; (c) Photomicrographs at 100 diameters unetched to show non-metallic inclusions.

4. The chemical analyses of bearings 1, 2 and 2GLZ are reported as follows:

	<u>Bearing 1</u>				<u>Bearing 2</u>				<u>2GLZ</u>			
	Inner	Outer	Balls	Ret.	Inner	Outer	Balls	Ret.	Inner	Outer	Balls	Ret.
Carbon	1.05	1.04	1.06	.09	1.06	1.02	.96	.07	.96	1.01	1.07	.11
Manganese	.37	.32	.33	.39	.35	.36	.37	.39	.29	.36	.28	.32
Phosphorous												
Sulphur												
Silicon												
Chromium	1.51	1.46	1.38		1.47	1.43	1.38		1.62	1.63	.62	
Nickel	.10	.23	.21		.08	.22	.25		.18	.22	.11	
Copper	.06	.12	.13		.06	.09	.13		.24	.20	.20	
Molybdenum	.02	.05	.03		.01	.06	.04		.03	.03	.01	

5. Conclusions drawn from these and former analyses of Soviet bearing 2GLZ are as follows:
- Bearing 2GLZ outlasts comparable American bearings under identical test conditions by more than 3 to 1.
 - Soviet bearing 2GLZ shows evidence of dimensional control, heat treating, and non-metallic contamination which may be deliberately engineered to produce a product just good enough to do the intended job.
 - The chemical composition of bearing 2GLZ is conventional but somewhat high in copper.
 - Bearing 2GLZ shows unexpectedly small grain size in the inner race.

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Appendix

X1000 Etched with Vilella's Reagent

Photo #5206

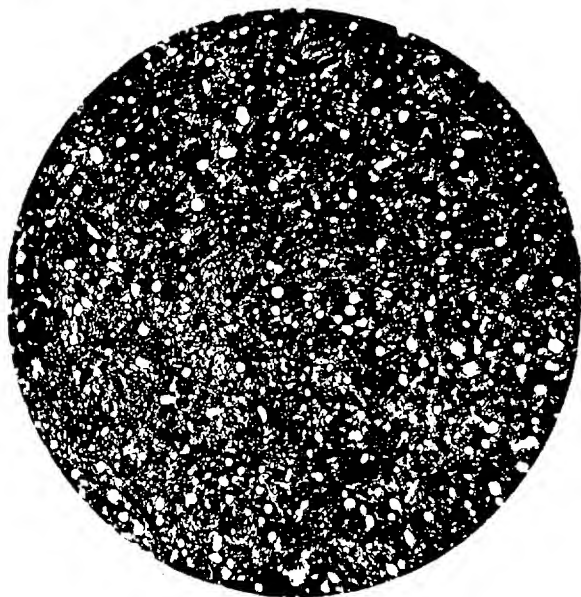


Figure 1
SKF #1 Inner

Photo #5203



Figure 2
"X" Inner (FGS-6 $\frac{1}{4}$)

Photo #5207

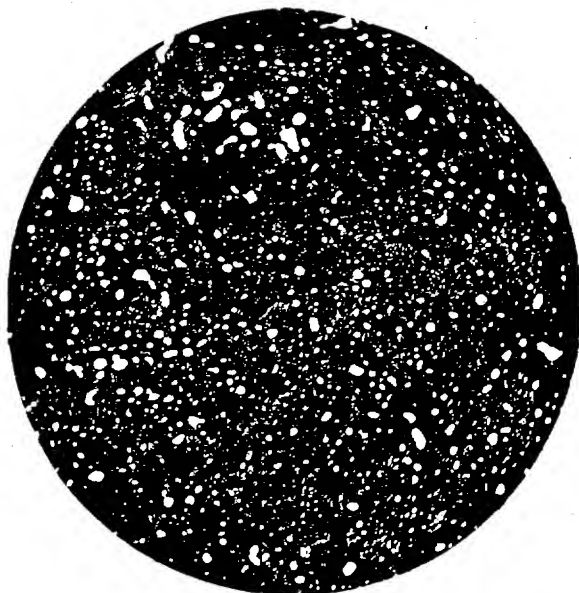


Figure 3
SKF #2 Outer

Photo #5204

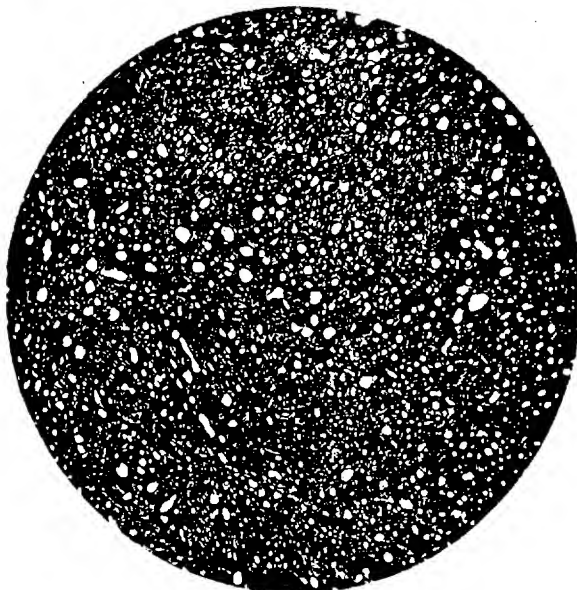


Figure 4
"X" Outer

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X100

Nital Etch

Photo #5208

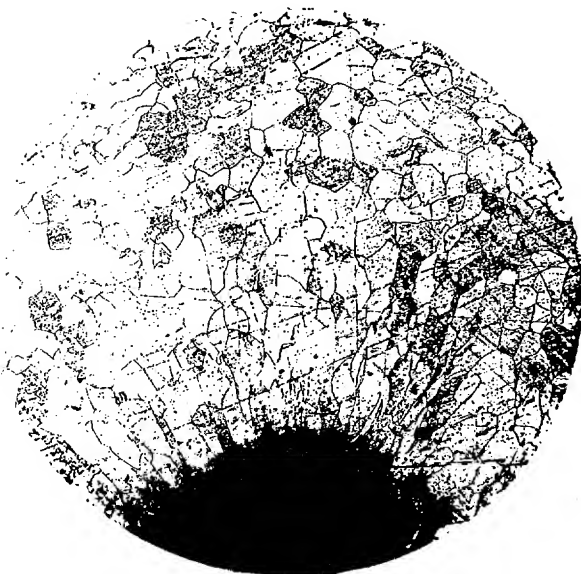


Figure 5
SKF #1 Retainer

Photo #5205

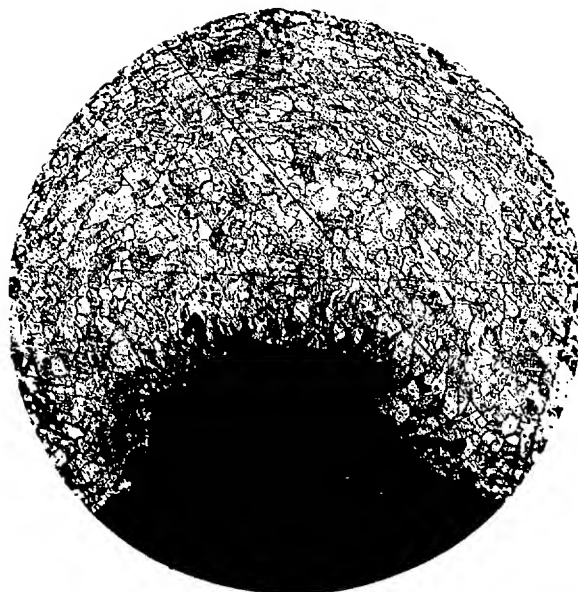


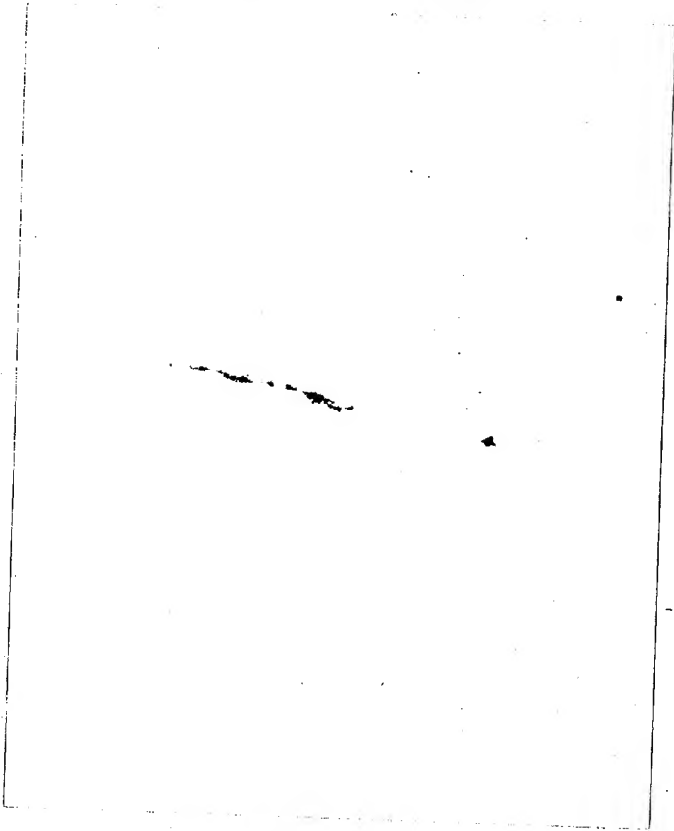
Figure 6
"X" Retainer

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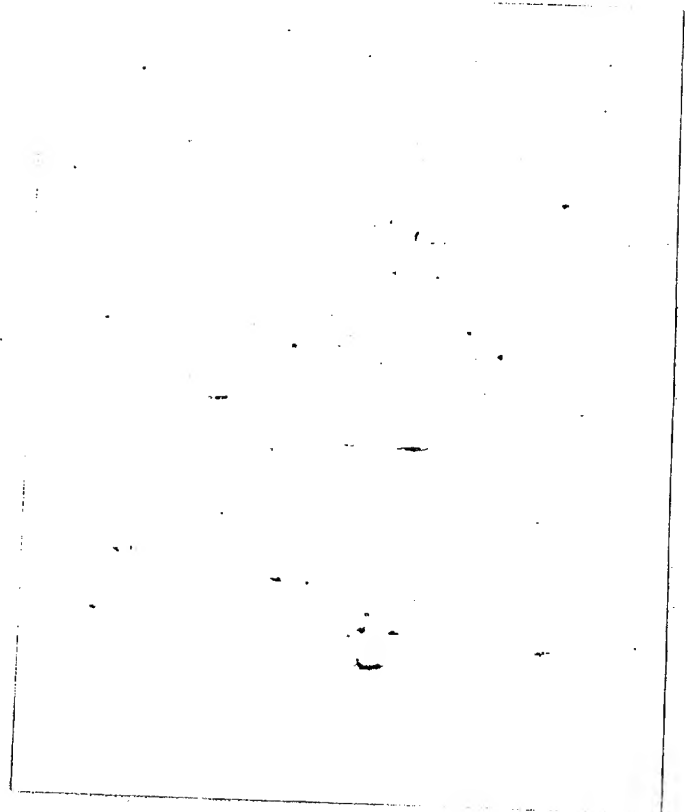
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Photo #5119
"X" Outer Ring



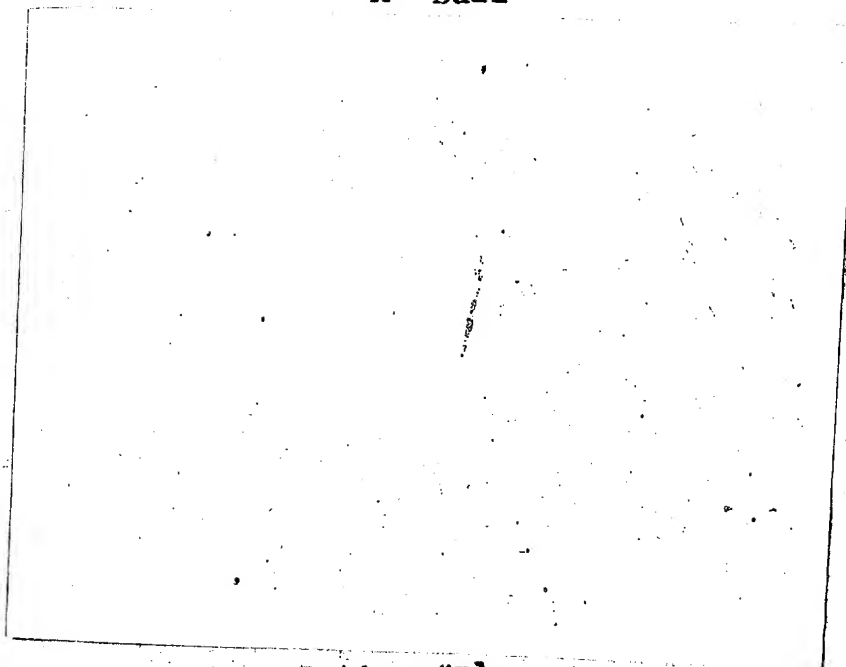
Rating #4

Photo #5121
"X" Inner Ring



Rating #3

Photo #5120
"X" Ball



Rating #3

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Non-Metallic Inclusion Rating 100X No Etch

Photo #5216
SKF #2 Outer Ring

Photo #5117
SKF #2 Inner Ring

Rating #3

Rating #3

Photo #5118
SKF #2 Ball

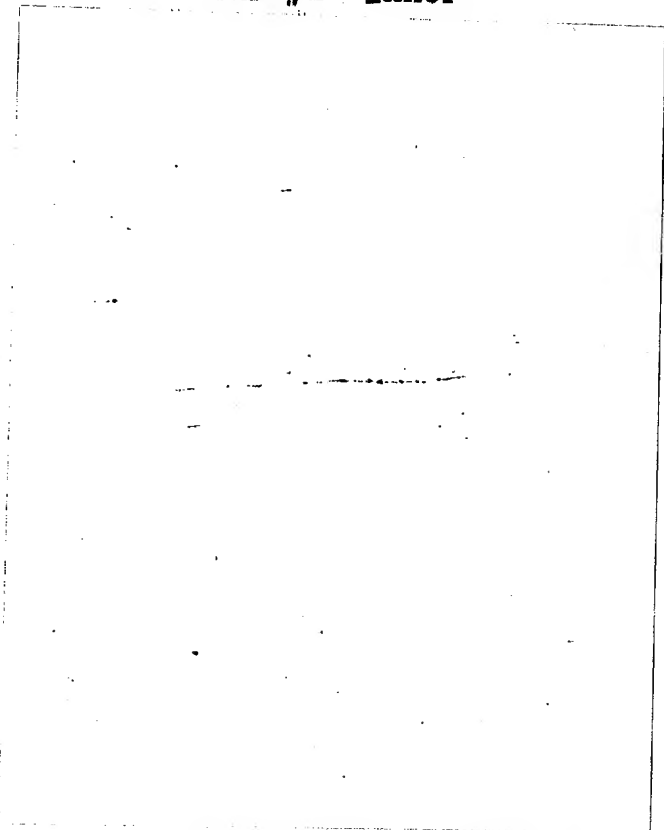
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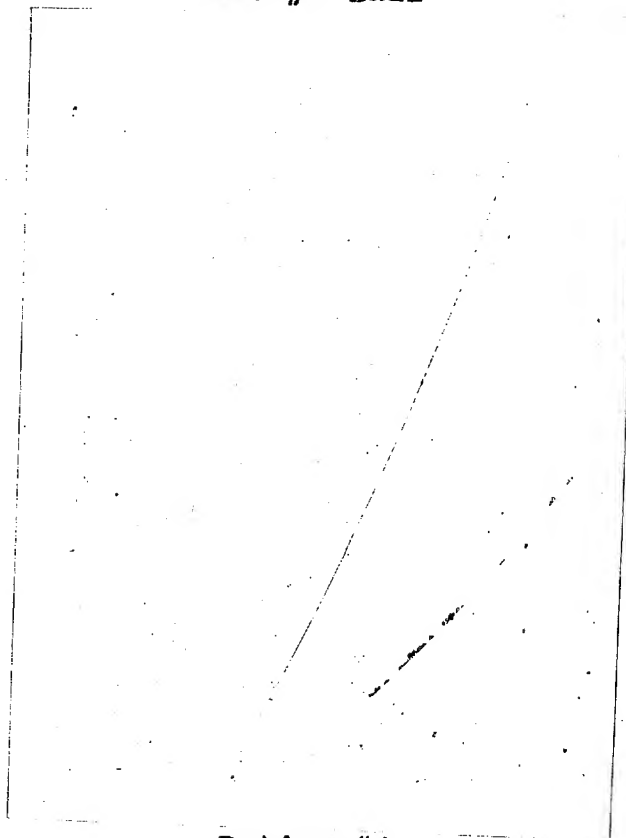
Photo #5122
SKF #1 Inner

Photo #5123
SKF #1 Ball



Rating #4

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Rating #4

Comments

The SKF #2 bearing parts showed manganese sulphides, large oxide and small silicate-type inclusions. However, the outer and inner would be just acceptable according to our standards. The ball would be considered objectionable because of the small chain-type silicate inclusions.

The "X" bearing parts would be all rejected according to our standards. The type of inclusions are oxide and manganese sulphide stringers.

The SKF #1 bearing parts would also be rejected according to our standards.

The inclusions are mostly all of the long oxide stringer type.

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